1. Find a solution to the equations
2. 
3. 
4. 

##### A boat with tourists looking for dolphins in Sandfly Sound ran aground at midday, at a place where the height of the sea level was given by



where  is the time in hours after midday,

and is the height of the sea level, in metres.

1. What is the difference in height between low and high tide?
2. What is the sea level at 2:30 p.m. that day?
3. What time elapses between low tide and high tide that day?
4. They can begin refloating the boat when the sea level is 2.7 m.

At what time, to the nearest minute, can they begin refloating?

1. This question uses the information A and B that you collected about your lung

capacity and breathing rate.

When fully exhaled the lungs still hold approximately 300 cm of air.

ie Assume minimum lung capacity = 300 cm

Total lung capacity = Minimum + volume A = ………….. cm \*\*

Time for one breath: 10 breaths = ………..seconds [B

Period [time for one breath] = …..……seconds ] \*\*

1. Using these pieces of information [\*\*] write down the equation to model your breathing, after exertion, in the form



where  is the volume of air in the lungs in cm at time  seconds

You may find it helpful to draw a sketch graph of for this question, which will imply that you are timing from the middle of your breath. In practice you may find it easier to take your practical measurements from the time when the person has completed exhaling.

1. (i) What is the total volume of air in your lungs, half way through one breathing cycle?

(ii) Give one time at which your lungs contain this amount of air.

1. After 30 seconds what volume of air do your lungs hold?
2. Prove that



5. Find the general solution, in radians, for 

1. A research scientist working on the generation of power by use of waves in water found that the type of wave motion shown in the graph below was more useful than a standard wave of constant height.



The equation of this wave is 

where is the height above mean sea level and  is the time in seconds.

Find the times at which the height of the wave is zero, for 

1. Sarah presented a solution to the problem

“Find the general solution to ” as follows:















Find the flaw(s), if any, in her reasoning, and correct the flaw(s) with a full explanation.

1. Prove that cosec *A*)

Assessment schedule: Calc/3/3– A version 2: “Breathing”

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|  | Criteria |  | Evidence | Judgement | Sufficiency |
| Achievement | Solve straightforward problems with models involving trigonometric functions. | 2a  2b  2c  1a  1b  1c | 4m  2.48 m  6 hours  Any value of  360n - 90  60n + 18.2  45n + (-1)n × 13.3o + 30° | Units not required anywhere in this task  Accept any rounding anywhere in this task  Only answers required  Only solution required  [or in RAD] | Achievement  Any 2 of 2a, 2b, 2c correct  Replacement Evidence could come from 3b(i), 3b(ii), 3c  AND  Any 2 of 1a, 1b, 1c correct  Replacement Evidence could come from 2d, 5, 6, 7 |
| Solve straightforward trigonometric equations. |
| Achievement with Merit | Solve problems with models that involve trigonometric functions.  Use trigonometric manipulation. | 3 a  b (i)  (ii)  c  2d  4  5 | The equation is of the form  where the values of A and B are as the student measured.    Consistent with (a) [ie ]  equation (a) with  substitution    t =2.712 h time of refloating is 2.43 p.m.        = | Consistent with the measured values  Consistent with the measured values  Consistent with the measured values  Or any other correct proof  Or equivalent solution | 3a correct [any rounding]  AND  Any 2 correct from 3b(i), 3b(ii), 3c  AND  Any 2correct from 2d, 4, and 5  Replacement Evidence for 4 could come from 8  Replacement Evidence for 2d and 5 could come from 6, 7 |
| Achievement with Excellence | Apply knowledge of trigonometric relationships to solve complex problem(s). | 6.  7.  8. | 0, 1, 2, 2,4, 5, 6  is also a solution to the equation  giving rise to the extra solutions | Q 6 must have at least 6 values correct  Must recognise the missing equation and solutions  or any other correct proof | 2 out of 6, 7, 8 correct |